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DETERMINE THE MOST APPROPRIATE DATE FOR PLANTING BROCCOLI (BRASSICA OLERACEAE L. VAR. ITALICA) SEEDS IN NINEVEH GOVERNORATE

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Abstract

The experiment was carried out in the vegetable field of Horticulture and Landscape Department / College of Agriculture and Forestry / University of Mosul, during the 2020-2021 season, to study the effect of five planting dates (1/8, 10/8, 15/8, 20/8 and 1/9) on vegetative growth and yield of broccoli (Matsuri) variety. The study was carried out in a simple experiment in a randomized complete block design(R.C.B.D), with three replications. The results showed that the second planting date (10 /8) recorded the highest values in chlorophyll content in leaves, Plant height, number of leaves per plant, and leaf area with a significant differences compared to the rest planting dates. Regarding to the yield traits, also the second planting date (10 /8) recorded the highest values in average weight of main curds, total yield of main curds, number of secondary curds, average weight of secondary curds, main curd circumference, plant and total yield of secondary curds, plant and total yield of main and secondary curds. Plants of the second and third planting dates showed a significant decrease in the number of days needed to form the main curds in comparison with the plants of the other planting dates, while the number of days needed to ripen 20% of the main curds was significantly reduced in the case of plants grown in the second and third dates compared to the plants grown in the first and fourth dates.

Keywords: Broccoli, Curds, Chlorophyll, Planting Dates.

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Introduction

Broccoli (*Brassica oleracea* L. var italica) belongs to the Brassicacea family, which contain many winter vegetable crops (Hassan, 2003). Its have a nutritional and medicinal value, as it is one of the richest crops of the cruciferous family in nutrients included in its composition and the most widely used in terms of medical, as it contains vitamins (A, B1, B2, B5, B6, B17, E) and the element calcium, manganese, zinc, iron and carotene which turns into vitamin A in the human body (Thapa and Rair, 2012) and its medical importance comes from contains antioxidants, which reduced the incidence of cancer diseases by 60% because it contains (glucoraphanin), which enhances immunity.

One of the most important agricultural operations which increase the productivity of Broccoli is the cultivation of this crop at different dates during the same season in order to prolong the presence of this crop in the market and for the longest possible period of time that can be achieved through successive planting, i.e. cultivation of the same variety

or other cultivars in different dates during the same growing season, with an emphasis on early cultivation (Al-Habar and Al-Rashidi, 2014). Many researchers have studied the planting dates of broccoli seeds. Ahmed and Wajid (2004) found that when they studied the effect of four dates for planting broccoli seeds (20/4, 5/5, 20/5 and 4/6) on growth and production in Pakistan that the planting date (5/5) gave the highest values for the number of leaves, plant height, main curds diameter, main curds weight, secondary curds weight, and total unit area product of main and secondary curd. The results of Hafiz et al. (2015) in Bangladesh to study the effect of four planting dates (2/10, 27/10, 21/11 and 16/12) for five varieties of broccoli showed that planting on the first date led to a significant increase in plant height and third planting date significantly superior in the average circumference of the main curds, the number of secondary curds, the average weight of the secondary curds, the plant yield of the main and secondary curds, and the total yield of the main and secondary curds compared to the rest planting dates.

Shehata, et. al.2017 study the effect of three planting dates (1 st September, 1 st October and 1st November) found that second planting date 1 st October gave the highest values of most vegetative growth traits expressed as number of leaves, leaf area and total fresh weight plant, as well as the highest values of main curds and total curds yield.

Arshad and Sherwan 2017 transplanting Broccoli seedlings in two dates, the first was on 20 the October and the second one was on 10 the November . The result indicated that planting date significantly influenced some vegetative growth characters of broccoli and higher result was recorded from the seedlings transplanted in 20 October (the average weight of main and secondary curds an total yield of curds. Fahmy (2017) study to the effect of three planting dates (15/7, 15/8, 15/9) broccoli growth, found that the second date gave the highest significant values for most vegetative growth traits, as leaves numbers and leaf area, and the highest values for most yield traits represented in the number of secondary curds, the average weight of the main curds, the total yield of the main and secondary curds, and the circumference of the main curds. In India a study was conducted by Kanase et al. (2018) on broccoli (Green Magic) cultivar which was sown on eight dates (11/10, 18/10, 25/10, 1/11, 8/11, 15/11, 22/ 11 and 29/11), it was noted that the date (1/11) was significantly superior to the rest of the dates in terms of plant height, number of leaves, leaf area, the average weight of the main curds the total yield of main curds, the circumference of the main curds, and the number of days to form the main curds and the number of days to harvest the main curds. In the semi-arid regions of Pakistan, the results of planting Broccoli in five dates (15/9, 1/10, 15/10, 1/11 and 15/11) showed that the early date (1/10) was superior in the percentage of chlorophyll in leaves and curd circumference, while the date (15/9) was significantly superior in the average weight of the secondary curds and the total yield of the main and secondary curds (Latif et al., 2019) . Al-Sudani and Al-Bayaty.2020 sowing Broccoli in three planting

dates (1/9, 15/9 and 1/10), the results showed that plants grown on the first date, was significantly higher in vegetative growth indicators represented by plant height, number of leaves, leaf area and fresh and dry weights of the total vegetative growth, and yield indicators that included weight ,and curd diameter, number and weight of lateral curds, yield of a plant and total productivity and the qualitative and chemical characteristics that included crud total chlorophyll concentration, vitamin C, total soluble carbohydrates, and the percentage of total nitrogen, phosphorous, potassium and sulfur.

The aim of this study is to determent the suitable planting dates for Broccoli in Mosul to give the highest quantitative and qualitative yield.

Materials and Methods

The experiment was carried out in the vegetable field of Horticulture and Landscap Department /College of Agriculture and Forestry/Mosul University, during the 2020-2021 season. The experiment included a comparison between five seed planting dates (1/8, 10/8, 15/8, 20/8 and 1/9) for the hybrid Broccoli cultivar (Matsuri) produced by the Japanese Tokita Company was used . D AP fertilizer (18% N) and 46% P) was added at a rate of 400 kg.ha-1, 20 days after transplanting while urea fertilizer (46% N) was added at a rate of 200 $kg.ha^{-1}$, at two batches the first one after 20 days of transplanting and the second at the beginning of curds formation, and potassium sulfate (50% K) at a rate of 100 $kg.ha^{-1}$ at the beginning of curds formation (Matlob et al., 1989).

The experiment was carried out in the field using a simple experiment in a randomized complete block design (R.C.B.D), with three replications. The seeds of the hybrid cultivar were sown in a wooden lath house in germination trays . The seedling was transplanting to the field after formation of 3-4 true leaves at 6/9/2020, 14/9/2020, 20/9/2020, 9/24/2020 and 10/4/2020 for the fief planting dates, respectively. .

1-The percentage of chlorophyll content of leaves (SPAD) , 2. Plant height (cm),3. Number of leaves per plant, 4. Leaf area ($cm^2.plant^{-1}$), 5- number of days for main curds formation,6- number of days for 20 % ripening of the main curds, 7. Average weight of the main curds (gm.), 8- Circumference of the main curds (cm), 9. Number of secondary curds, 10. average weight of secondary curds (g.),11- plant yield of secondary curds (g.). 12- plant yield of main and secondary curds (g.plant-1),, 13. total yield of the main curds ($ton.ha^{-1}$) .14-Total yield of secondary curds ($ton.ha^{-1}$), 15- Total yield of main and secondary curds ($ton.ha^{-1}$).

The results were statistically analysis according to the statistical analysis system (SAS) and compared with the means by Duncan multiple rang test at 0.05 level (Al-Rawy, & Khalaf-Allah,2000).

Results:

The data in table (1) showed the effect of planting dates in chlorophyll content, plant height, number of laves per plant, and leaf area. The results indicated that the plants of the second sowing date were significantly superior in the percentage of leaf content of chlorophyll (57.10), plant height (83.83 cm), leaf area (116054, cm^2), and number of laves per plant (22.78) than the other sowing dates.

Table 1: effect of planting dates in chlorophyll content, plant height, number of laves per plant, and leaf area.

Planting dates	chlorophyll content (SPAD)	Plant height (cm)	Number of laves per Plant	Leaf area (cm^2)
1/8	36.11 c	71.31 c	22.60 a	72022 b
10/8	57.10 a	83.83 a	22.87 a	116054 a
15/8	46.88 b	81.72 ab	20.20 b	75947 b
20/8	51.90 ab	77.22 b	20.33 b	67089 b
1/9	46.93 b	69.16 c	18.33 c	64113 b

Means followed by the same letter are not significantly different according to Duncan multiple range test at the probability of P=0.05 level.

Table 2: illustrated the effect of planting dates in number of days for main curds formation and 20% main curds ripening, number of secondary curds, and circumference of the main curd. It was found that the second sowing date (10/8) rerecord the lowest number of days for main curds formation (96.53) and 20% main curds ripening (152.53), and the highest value of number of secondary curds per plant (2.64) and circumference of the main curd(51.67)with significant superior than other planting dates.

Table 2: effect of planting dates in number of days for main curds formation and 20% main curds ripening, number of secondary curds, and circumference of the main curd

Planting dates	Number of days for main curds formation	Number of days for 20 % main curds ripening	Number of secondary curds per plant	Circumference of the main curd (cm)
1/8	106.81 b	162.00 a	2.04 b	45.52 b
10/8	96.53 c	152.53 c	2.64 a	51.67 a
15/8	97.25 c	153.00 c	2.44 a	42.76 b
20/8	104.60 b	159.00 ab	1.72 b	36.08 c
1/9	113.53 a	155.17 bc	1.77 b	25.47 d

Means followed by the same letter are not significantly different according to Duncan multiple range test at the probability of P=0.05 level.

Table 3 revealed the effect of planting dates in average weight of the main and secondary curds, plant yield of secondary curds, and plant yield of main and secondary curds. It was found that the second sowing date (10/8) rerecord the highest values of average weight of the main curd (640.01gm.), average weight of secondary curd (33.22 gm.), plant yield of secondary curds (88.36 gm.), and plant yield of main and secondary curds (728.37 gm.).While the lowest values of the four parameters was from the five sowing date (1/9) which rerecord (127.73, 17.75, 31.63, 159.36 gm.) respectively.

Table 3: effect of planting dates in average weight of the main and secondary curds, plant yield of secondary curds, and plant yield of main and secondary curds

Planting dates	Average weight of the main curds (gm.)	Average weight of secondary curds (gm.)	plant yield of secondary curds (gm.)	plant yield of main and secondary curds(gm.)
1/8	462.95 b	31.87 a	64.98 a	527.93 b
10/8	640.01 a	33.22 a	88.36 a	728.37 a
15/8	426.49 b	28.92 a	70.74 a	497.23 b
20/8	265.47 c	19.87 b	34.14 b	299.61 c
1/9	127.73 d	17.75 b	31.63 b	159.36 d

Means followed by the same letter are not significantly different according to Duncan multiple range test at the probability of P=0.05 level.

Table 4 revealed the effect of planting dates in total yield of main curds, total yield of secondary curds, and total yield of main and secondary curds (ton.ha^{-1}). The results showed that the second sowing date (10/8) rerecord the highest values of total yield of main curds (24.253 ton.ha^{-1}) , total yield of secondary curds (3.3486 ton.ha^{-1}), and total yield of main and secondary curds (27.602 ton.ha^{-1}). While the lowest values of the three parameters was from the five sowing date (1/9) which rerecord (4.840, 1.1986, 6.039 ton.ha^{-1}) .

Table 4: effect of planting dates in total yield of main curds, total yield of secondary curds, total yield of main and secondary curds (ton.ha^{-1})

Planting dates	Total yield of main curds (ton.ha^{-1})	Total yield of secondary curds (ton.ha^{-1})	Total yield of main and secondary curds (ton.ha^{-1})
1/8	17.543 b	2.4622 a	20.006 b
10/8	24.253 a	3.3486 a	27.602 a
15/8	16.162 b	2.6806 a	18.842 b
20/8	10.060 c	1.2937 b	11.354 c
1/9	4.840 d	1.1986 b	6.039 d

Means followed by the same letter are not significantly different according to Duncan multiple range test at the probability of P=0.05 level.

Discussion:

It was found from the results of Tables (1-4) that there were a significant superiority of the plants sowing on the second date 8/10 in all characteristics of vegetative growth and quantitative and qualitative yield characteristics. This may be due to the appropriate environmental conditions of maximum and minimum temperatures and photoperiod during the sowing date, which led to an increase in vegetative growth. The vegetative effect and the increase in the efficiency of the photosynthesis process and the building of carbohydrates in the leaves and their transfer to the active growth areas and accumulation of manufactured materials and thus cause an increase in the number of leaves per plant which increase the leaf area of the plant. The plants of the second date sowing may have been exposed to vernalization than the plants of other dates, because the emergence of the curds determined on vernalization, and the increase in all the characteristics of vegetative growth led to an increase in the nutrients manufactured in the plant, their transmission and accumulation in the active parts and thus led to an increase in the yield of plants This is the date (Abdul-

Rahman and Muhammad, 2017), and this is consistent with Hassan (2004) that broccoli needs a moderate atmosphere that tends to warmth during the vegetative growth stage at the beginning of its life,

.Also the superiority of the second planting date 8/10 in yield and its components represented by main and lateral curds weight, diameter, plant yield, and total productivity might be attributed to the availability of favorable environmental conditions for vegetative growth and its reflection on the increase of the processed nutrients accumulated inside the plant, which led to an increase in the plant total yield and thus an increase in the total productivity, this comes in line with Jarjnazi (2020) who emphasized that the favorable climatic conditions led to the superiority of plants in all studied characteristics and that the superiority in vegetative growth (number and length of leaves) worked to increase the efficiency of the photosynthesis process and thus increasing the processed nutrients.

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